Comments
On
Traffic Impact Analyses

PERSONAL EXPERIENCE

16 years as Scottsdale Traffic Engineer

13 years as Consulting Traffic Engineer

Completed over 200 Traffic Impact Studies

Reviewed over 50 Traffic Impact Studies

ITE Journal Peer Reviewer for Trip Generation Articles

ITE Committees for:

3rd Edition Trip Generation Handbook

10th Edition Trip Generation Manual

TRAFFIC IMPACT ANALYSIS PURPOSE

Ensure Safe and Efficient Transportation

Primary Beneficiary – Business and Customers

Secondary Beneficiary – Travelers and Public Agency

TYPICAL PRELIMINARY MEETING

Existing and Proposed Land Uses

Preliminary Site Plan

Analysis Scope

- Small – Trip Generation Comparison Only
- Medium – Close Intersection(s) and Opening Year
- Large – Numerous Intersections and Years

Some Agencies Second Meeting

- Trip Generation and Trip Distribution

ANALYSIS PERIODS

Weekday

Weekday Morning and Evening Peak Hour

- Adjacent Street
- Generator

Saturday Peak Hour

DOMINATING DECISIONS

- Trip Generation
  - Land Use and Independent Variable
  - Rate versus Equation versus Plotted Points
- Trip Distribution
  - Population or Employment or Traffic Volumes
- Peak Hour Factor (Variation within Hour)
  - Current versus Site versus Future

TYPICAL SECTIONS

Executive Summary

Proposed Development

Area Conditions

Projected Traffic: Without and With Site

Level-of-Service Analyses

Results

Recommendations

Conclusions

MIXED-USE DEVELOPMENT

NOT Mixed-use Developments

Most typical shopping centers

(only if large non-retail, non-restaurant generators)

Most typical office parks and office buildings

(only if large non-office generators)

Most hotels

(only if large non-hotel, non-restaurant generators)

MIXED-USE DEVELOPMENT

Characteristics

Not Trip Generation Manual designated land use

Downtown fringe, general urban, suburban

100,000 to 2,000,000 square feet building area

Less than 300 acres

Weekday peak periods only

Robust, multiple, direct internal pedestrian and vehicle connections

Robust, multiple, direct internal pedestrian and vehicle connections

MIXED-USE DEVELOPMENT

INTERNAL PERSON-TRIP CAPTURE RATE

FROM	TO	WEEKDAY AM	WEEKDAY PM
Office	Retail	28%	20%
	Restaurant	63%	4%
	Entertainment	0%	0%
	Residential	1%	2%
	Hotel	0%	0%
Restaurant	Office	31%	3%
	Retail	14%	41%
	Entertainment	0%	8%
	Residential	4%	18%
	Hotel	3%	7%

DETERMINATION OF TRIP GENERATION RATE FROM TRAFFIC COUNTS

WEIGHTED Average Rate
Not Average Rate

SITE	INDEPENDENT VARIABLE	TRIPS	RATE
A	43	11	0.26
B	49	83	1.69
C	15	34	2.27
D	48	65	1.35
E	38	40	1.05
TOTAL	193	233	

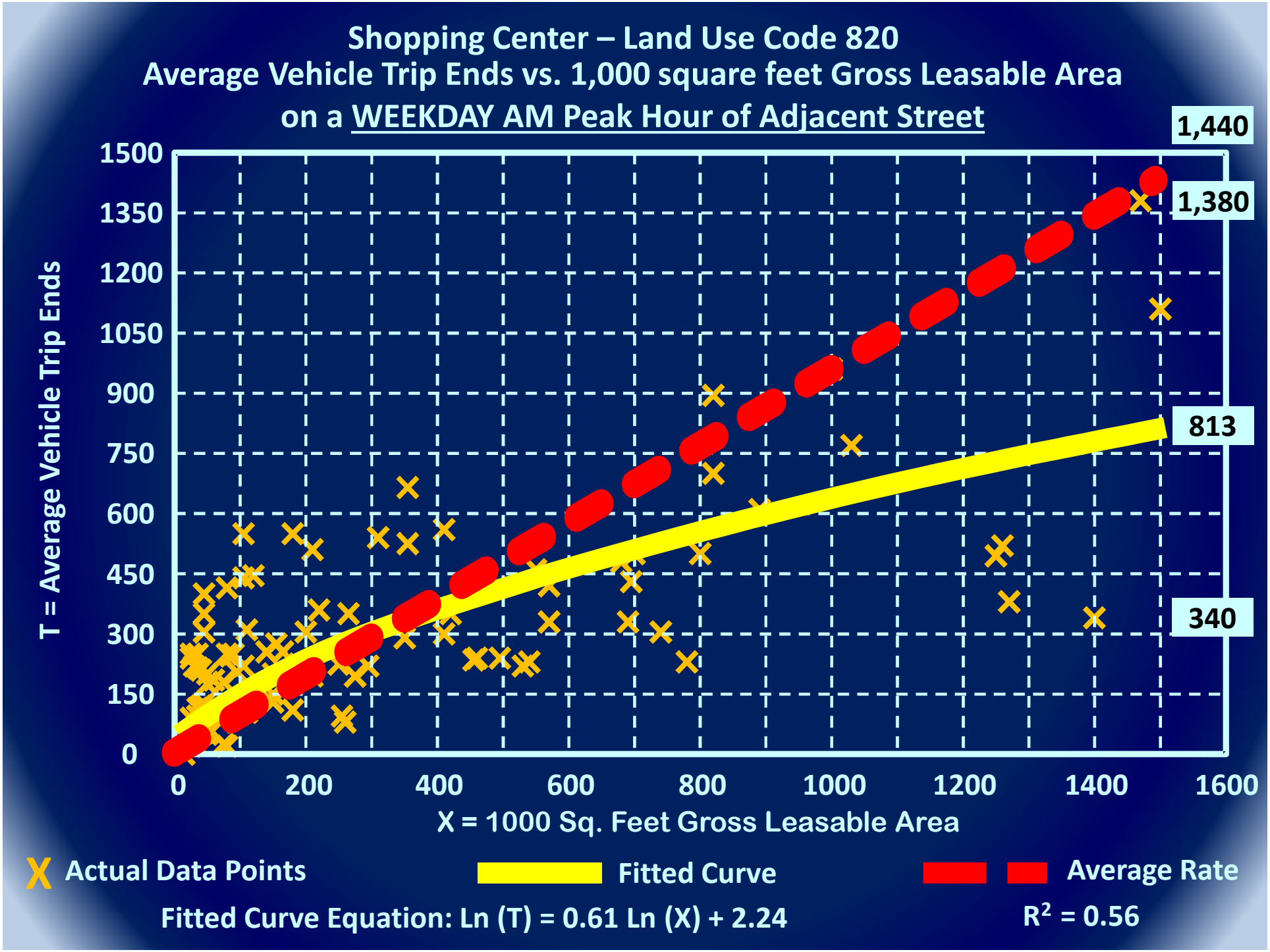
AVERAGE OF RATES (trips-per-independent-variable) 1.32

WEIGHTED AVERAGE RATE (trips-per-independent-variable) 1.21

Trip Generation Techniques

Trips versus Independent Variables

1. Plotted points
2. Weighted average rate
3. Fitted equation

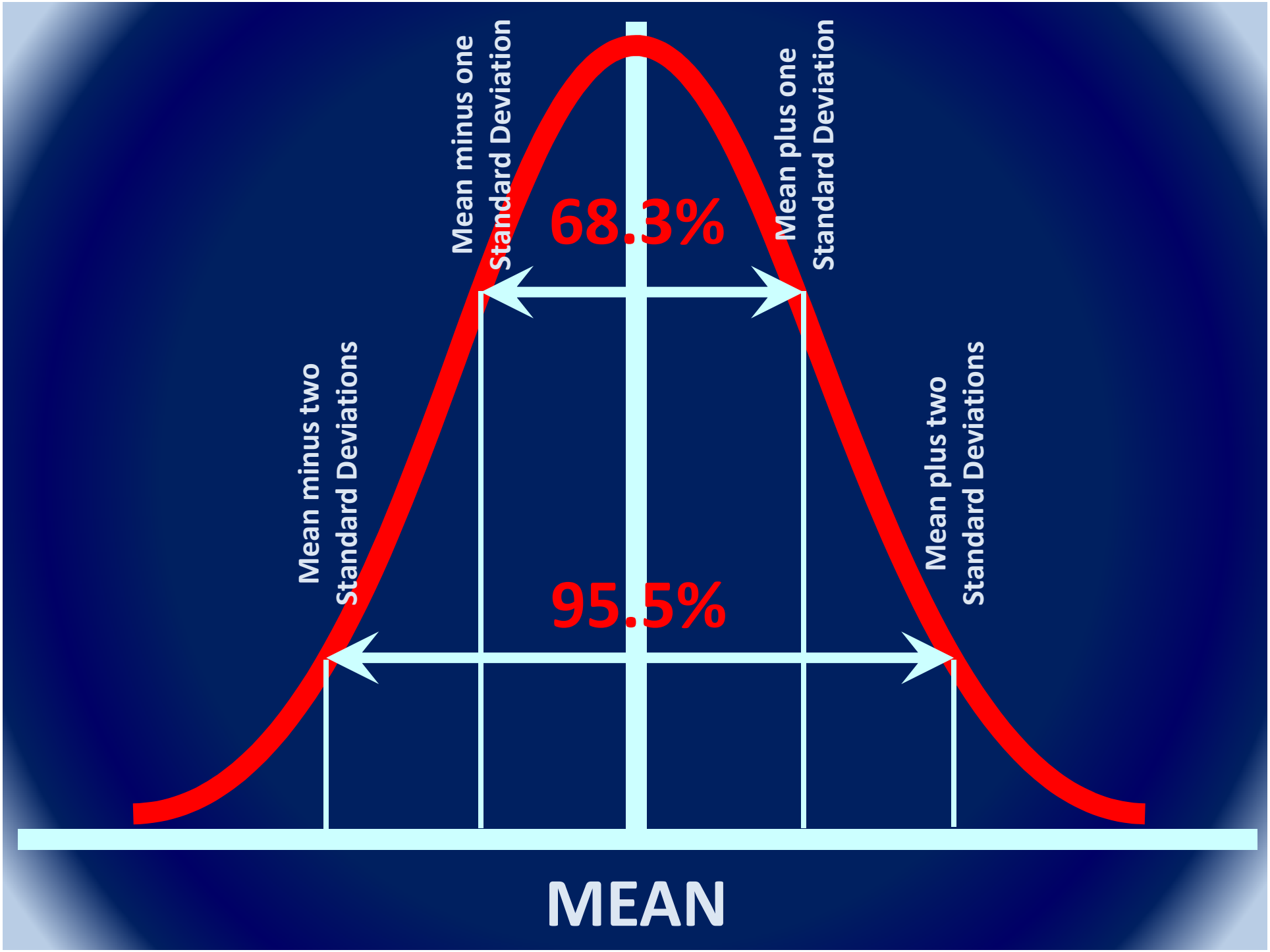

Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area
on a WEEKDAY AM Peak Hour of Adjacent Street
1,440
1,380
813
340
T = Average Vehicle Trip Ends
1500
1350
1200
1050
900
750
600
450
300
150
0
0
200
400
600
800
1000
1200
1400
1600
X = 1000 Sq. Feet Gross Leasable Area
Actual Data Points
Fitted Curve
Average Rate
Fitted Curve Equation: Ln (T) = 0.61 Ln (X) + 2.24
R² = 0.56

AVERAGE RATE

MEAN

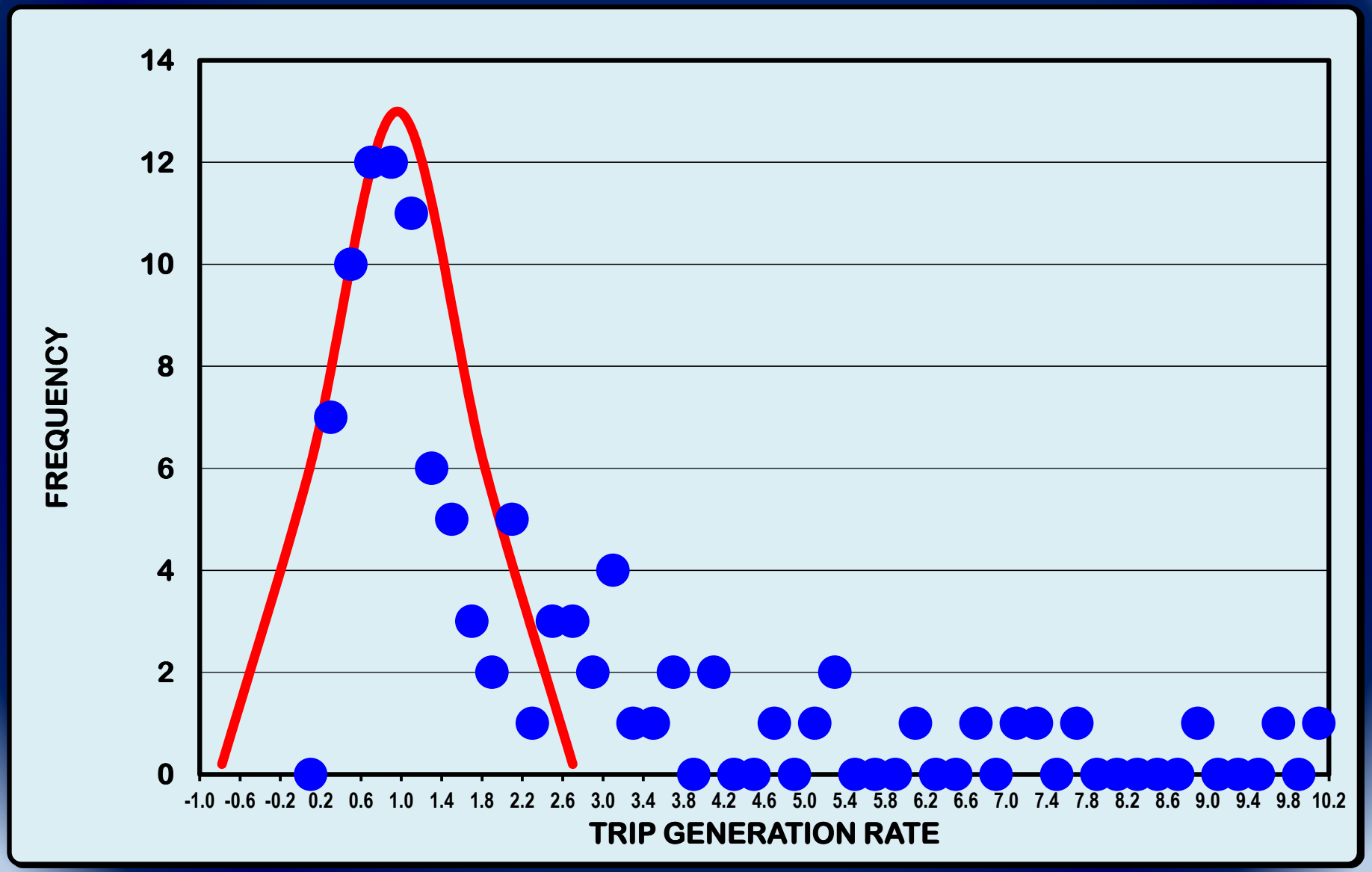
AND

NORMAL DISTRIBUTION


Mean minus two
Standard Deviations
Mean minus one
Standard Deviation
68.3%
Mean plus one
Standard Deviation
95.5%
Mean plus two
Standard Deviations
MEAN

Shopping Center – Land Use Code 820 Weekday AM Peak Hour

Study Data Trip Generation Rate Distribution (0.20 Aggregation)



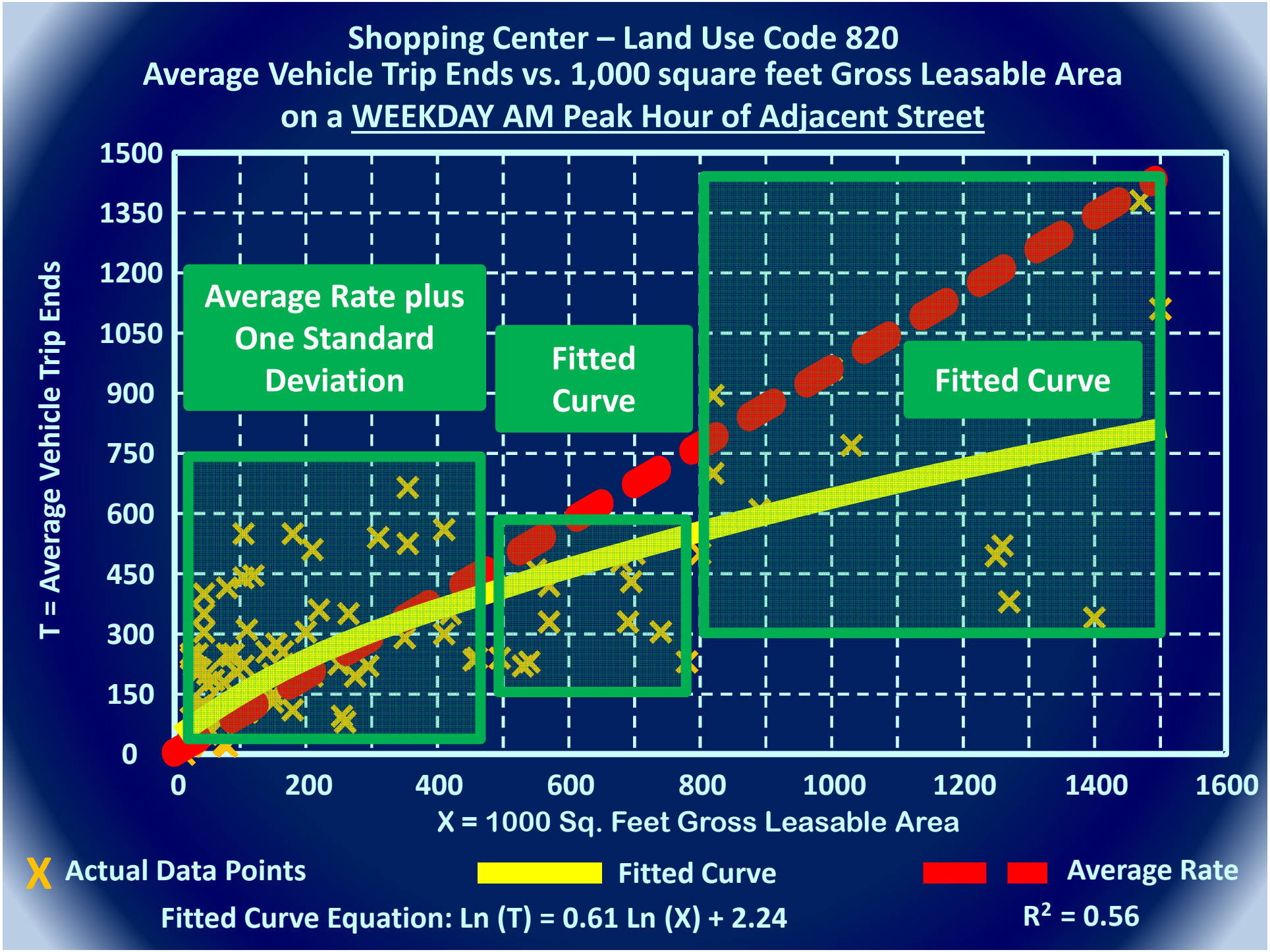
Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area
on a WEEKDAY AM Peak Hour of Adjacent Street

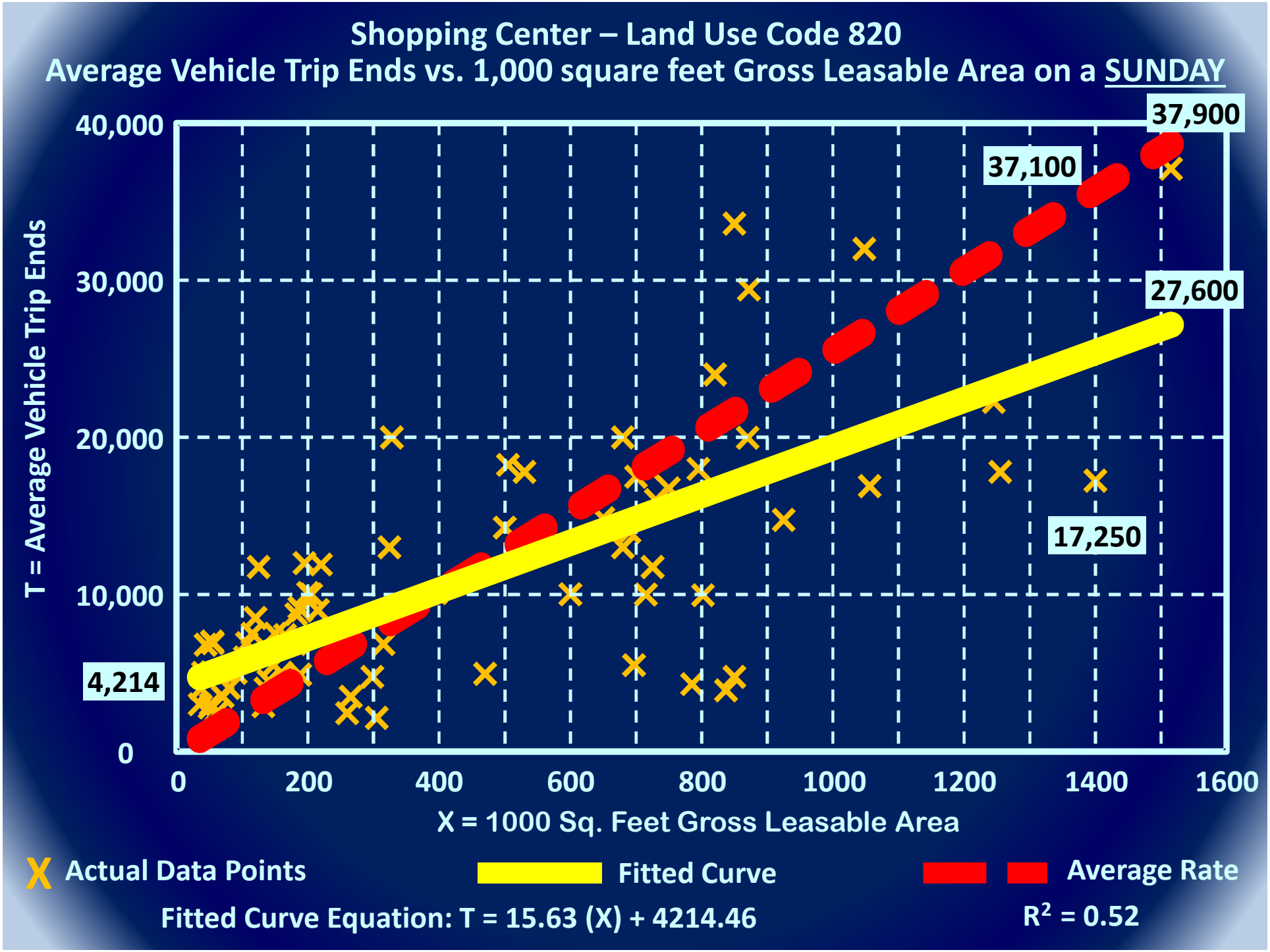
Average Rate	Range of Rates	Standard Deviation
0.96	0.10 – 9.05	0.87

Low Rates:	0.96 – 0.87 = 0.09 < 0.10	ACCEPTABLE
High Rates:	0.96 + 0.87 = 1.85 < 9.05	UNACCEPTABLE

Low Rates:	0.96 – 1.74 = - 0.78 < 0.10	ACCEPTABLE
High Rates:	0.96 + 1.74 = 2.70 < 9.05	UNACCEPTABLE

Weighted Average Rate:	0.96
Average of Rates:	2.06


Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area
on a WEEKDAY AM Peak Hour of Adjacent Street
T = Average Vehicle Trip Ends
1500
1350
1200
1050
900
750
600
450
300
150
0
Average Rate plus One Standard Deviation
Fitted Curve
Fitted Curve
0
200
400
600
800
1000
1200
1400
1600
X = 1000 Sq. Feet Gross Leasable Area
X Actual Data Points
Fitted Curve
Average Rate
Fitted Curve Equation: Ln (T) = 0.61 Ln (X) + 2.24
R² = 0.56


Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area on a SUNDAY
T = Average Vehicle Trip Ends
40,000
30,000
20,000
10,000
0
37,900
37,100
27,600
17,250
4,214
0
200
400
600
800
1000
1200
1400
1600
X = 1000 Sq. Feet Gross Leasable Area
X Actual Data Points
Fitted Curve
Average Rate
Fitted Curve Equation: T = 15.63 (X) + 4214.46
R² = 0.52

Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area
on a SUNDAY

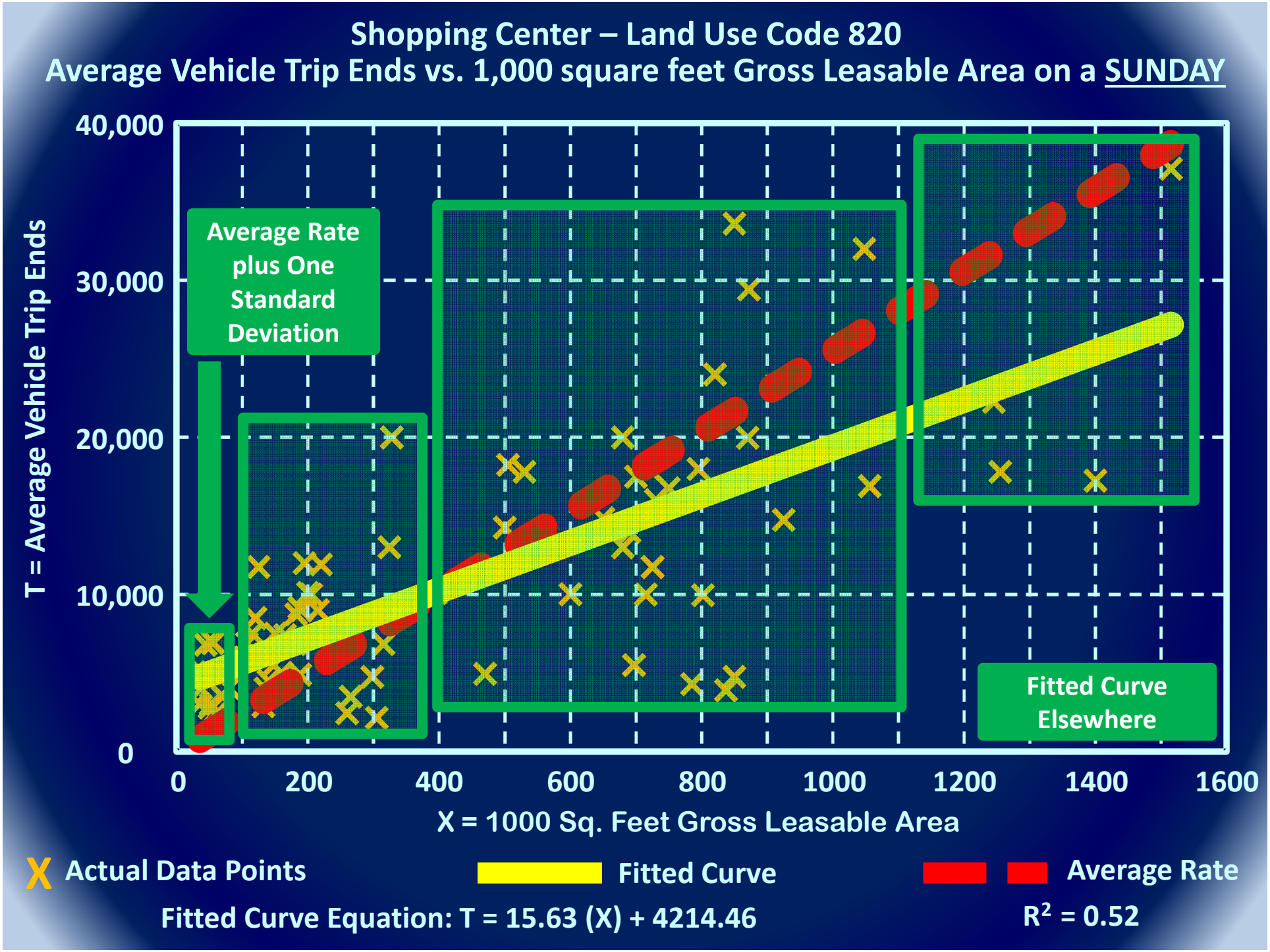
Average Rate	Range of Rates	Standard Deviation
25.24	4.15 – 148.15	16.59

Low Rates: 25.24 – 16.59 = 8.65 > 4.15 UNACCEPTABLE

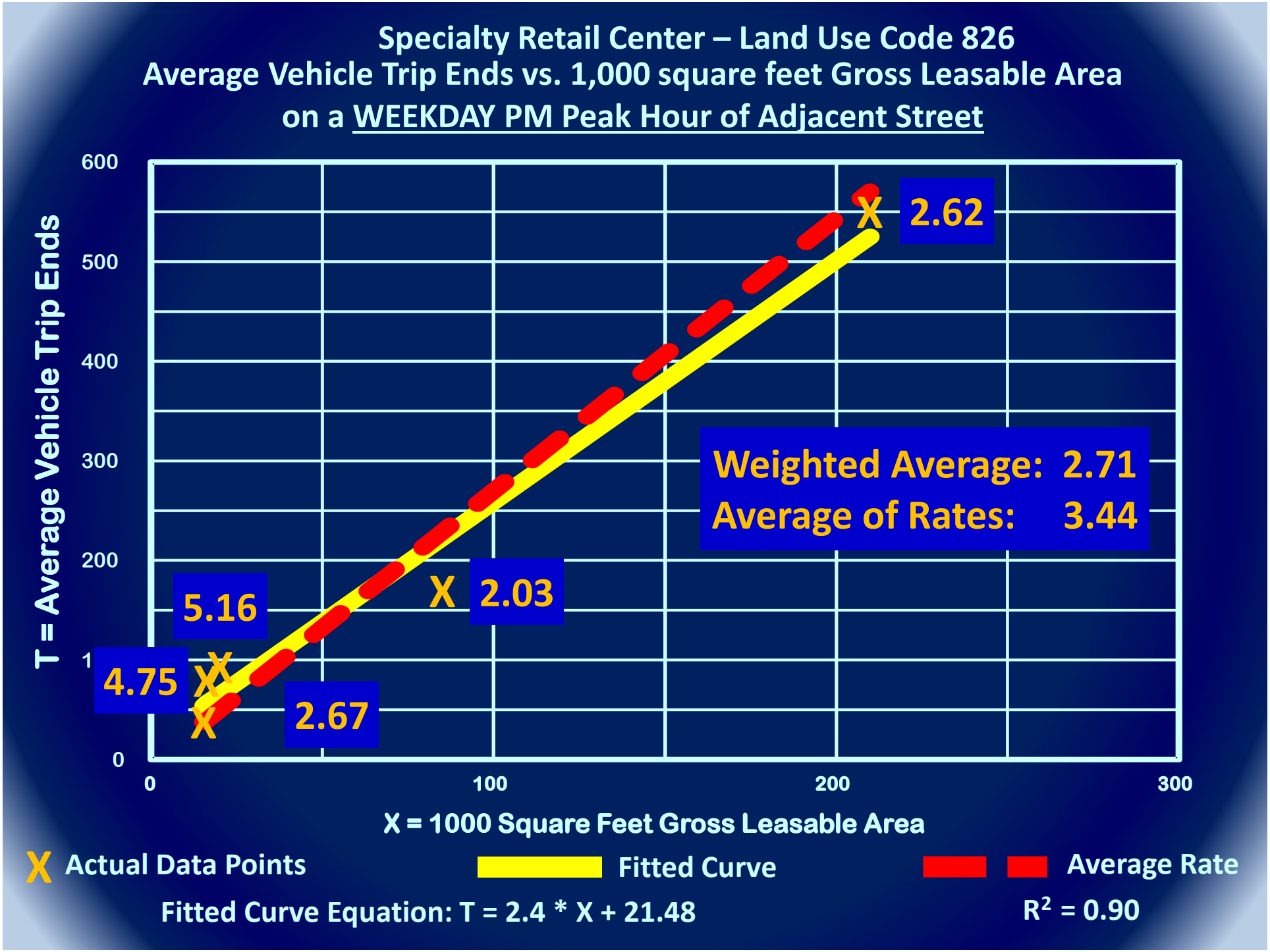
High Rates: 25.24 + 16.59 = 41.83 < 148.15 UNACCEPTABLE

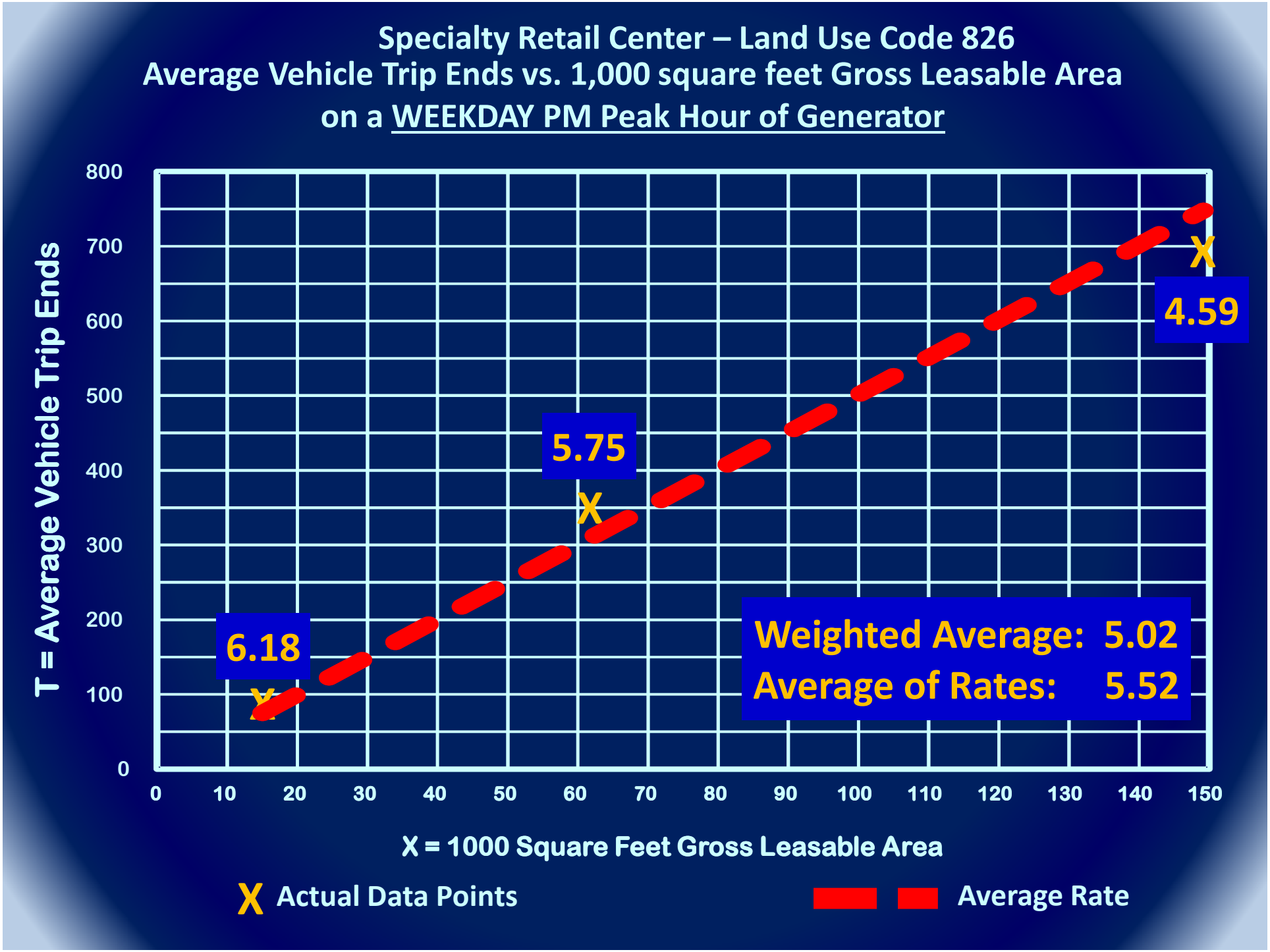
Low Rates: 25.24 – 33.18 = - 7.94 < 4.15 ACCEPTABLE

High Rates: 25.24 + 33.18 = 58.42 < 148.15 UNACCEPTABLE


Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area on a SUNDAY
T = Average Vehicle Trip Ends
40,000
30,000
20,000
10,000
0
Average Rate plus One Standard Deviation
Fitted Curve Elsewhere
0
200
400
600
800
1000
1200
1400
1600
X = 1000 Sq. Feet Gross Leasable Area
X Actual Data Points
Fitted Curve
Average Rate
Fitted Curve Equation: T = 15.63 (X) + 4214.46
R² = 0.52

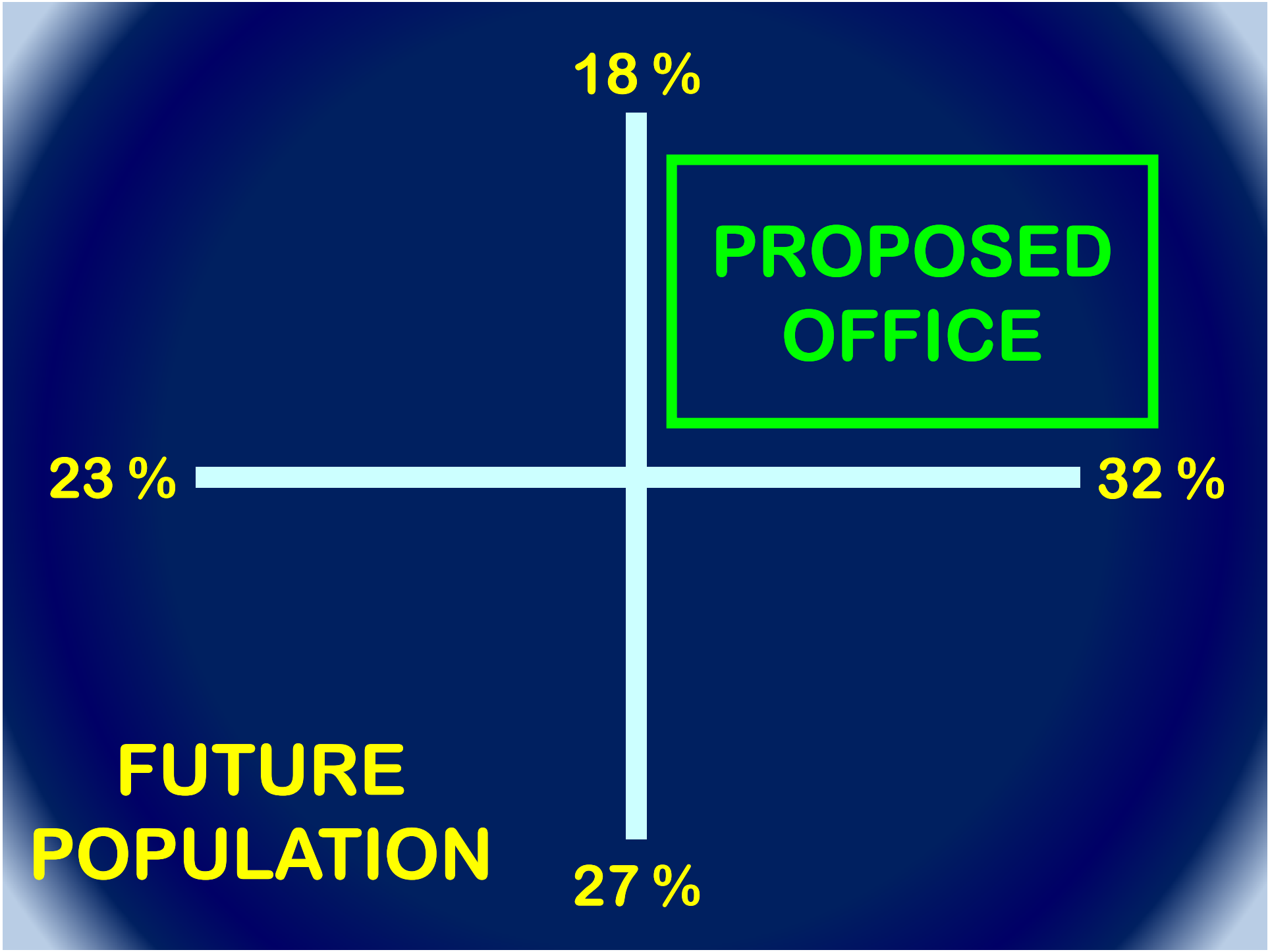
Trip Generation With Few Data Points

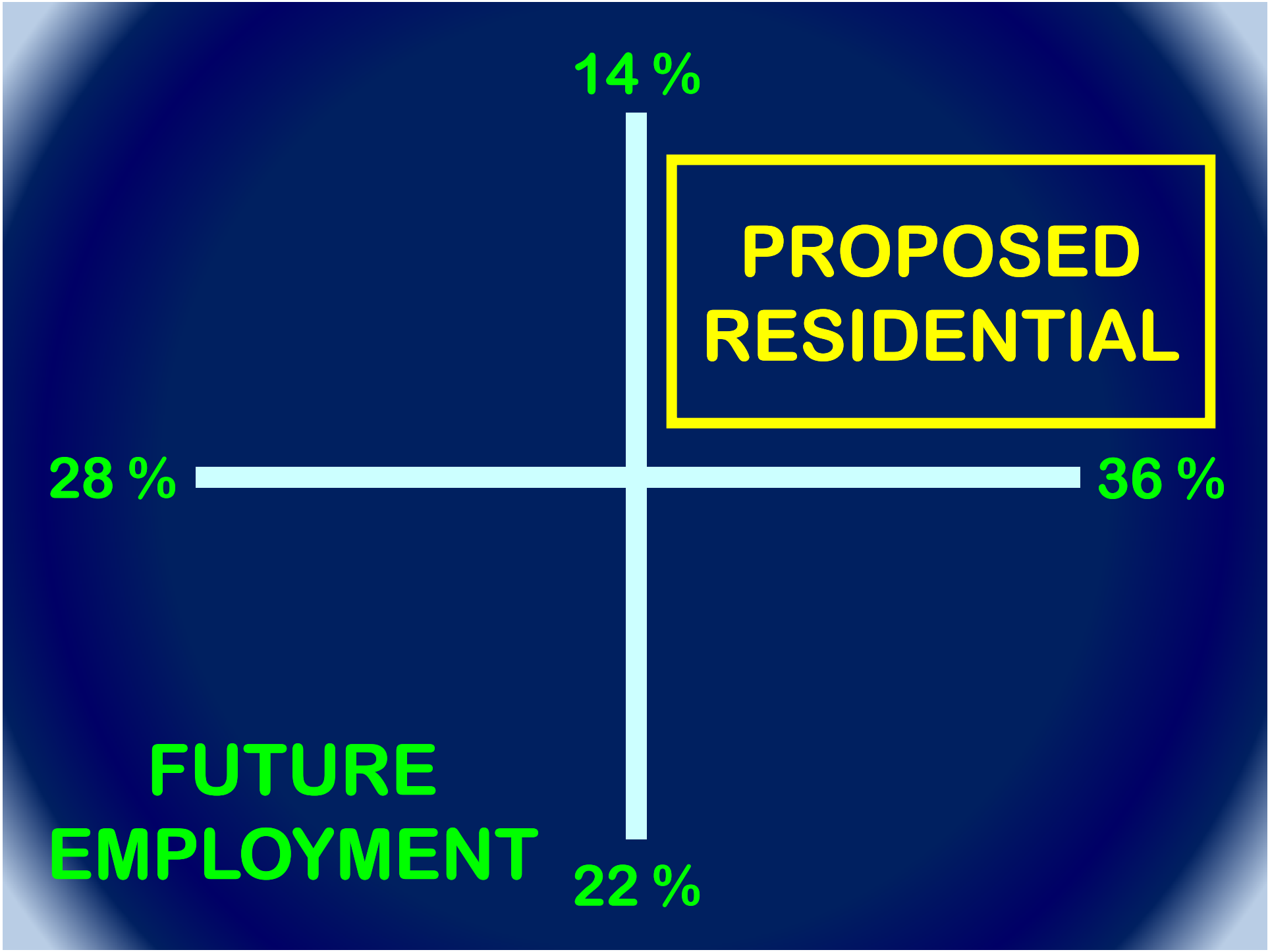

Specialty Retail Center – Land Use Code 826
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area
on a WEEKDAY PM Peak Hour of Adjacent Street
T = Average Vehicle Trip Ends
600
500
400
300
200
1
0
0
100
200
300
X = 1000 Square Feet Gross Leasable Area
2.62
5.16
2.03
4.75
2.67
Weighted Average: 2.71
Average of Rates: 3.44
X Actual Data Points
Fitted Curve
Average Rate
Fitted Curve Equation: T = 2.4 * X + 21.48
R² = 0.90

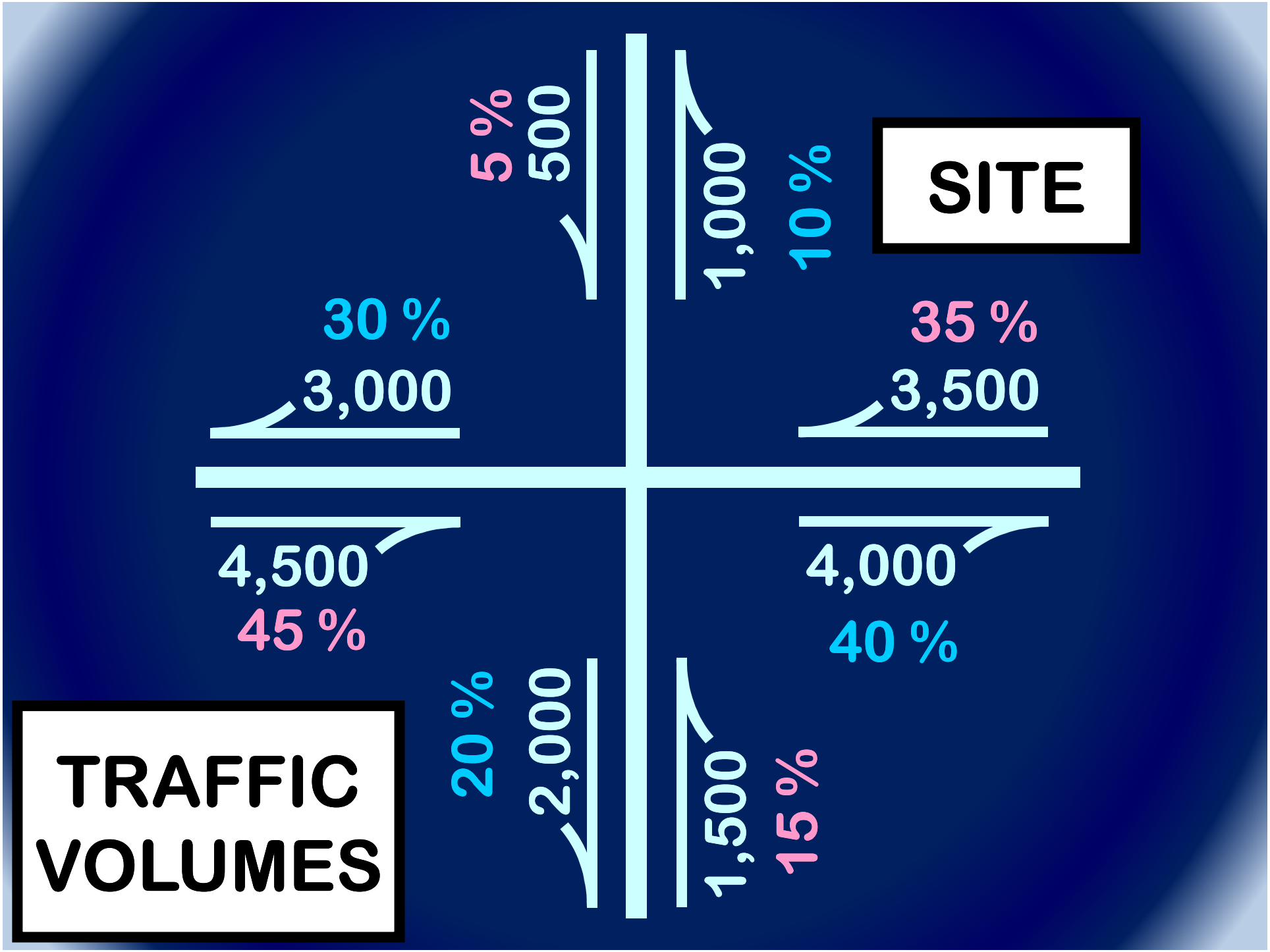

Specialty Retail Center – Land Use Code 826
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area
on a WEEKDAY PM Peak Hour of Generator
T = Average Vehicle Trip Ends
0
100
200
300
400
500
600
700
800
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
X = 1000 Square Feet Gross Leasable Area
6.18
5.75
4.59
Weighted Average: 5.02
Average of Rates: 5.52
X Actual Data Points
Average Rate

Trip Distribution

Choices


18 %
PROPOSED
OFFICE
23 %
32 %
FUTURE
POPULATION
27 %


14 %
PROPOSED
RESIDENTIAL
28 %
36 %
FUTURE
EMPLOYMENT
22 %


SITE
5 %
500
1,000
10 %
30 %
3,000
35 %
3,500
4,500
45 %
4,000
40 %
20 %
2,000
1,500
15 %
TRAFFIC
VOLUMES

Peak Hour Factor

TIME	LEFT	THRU	RIGHT	TOTAL
7:30	94	67	4	165
7:45	175	91	9	275
8:00	110	95	7	212
8:15	63	73	5	141
TOTAL	442	326	25	793

Peak Hour Factor

$$\frac{793}{4 * 275}$$

$$= 0.72$$

Design Hour Volume

$$\frac{\text{Hourly Volume}}{0.72}$$

Sensitivity Analysis

Dual Left–turn lanes

If left-turn volume
> 300 vehicles-per-hour

Existing left–turn volume is 155 vph

Site left-turn volume is 135 vph

Dual left-turn lane if 300 vph

Existing = 155 vph Site = 135 vph

$$\frac{300 - (155 + 135)}{135}$$

$$= 7\%$$

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